IEC 60846-1

Edition 1.0 2009-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation – Part 1: Portable workplace and environmental meters and monitors

Instrumentation pour la radioprotection – Instruments pour la mesure et/ou la surveillance de l'équivalent de dose (ou du débit d'équivalent de dose) ambiant et/ou directionnel pour les rayonnements bêta, X et gamma – Partie 1: Instruments de mesure et de surveillance portables pour les postes de travail et l'environnement

IEC 60846-1:2009

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:
Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,…). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:
Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

IEC 60846-1

Edition 1.0 2009-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation – Part 1: Portable workplace and environmental meters and monitors

Instrumentation pour la radioprotection – Instruments pour la mesure et/ou la surveillance de l'équivalent de dose (ou du débit d'équivalent de dose) ambiant et/ou directionnel pour les rayonnements bêta, X et gamma – Partie 1: Instruments de mesure et de surveillance portables pour les postes de travail et l'environnement

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX XA

ICS 13.280 ISBN 978-2-88910-308-9

CONTENTS

FOREWORD ... 6
1 Scope and object ... 8
2 Normative references ... 9
3 Terms and definitions ... 10
4 Units and list of symbols ... 15
4.1 Units ... 15
4.2 List of symbols ... 16
5 General characteristics of ambient and directional dose equivalent (rate) meters ... 18
5.1 Indication ... 18
5.2 Read-out ... 18
5.3 Dose equivalent rate range ... 18
5.4 Effective range of measurement ... 18
5.5 Minimum range of measurement ... 19
5.6 Rated range of an influence quantity ... 19
5.7 Minimum rated range of influence quantity ... 19
5.8 Alarm levels ... 19
5.9 Additional indication ... 20
5.10 Failure operation of indication ... 20
5.11 Ease of decontamination ... 20
5.12 Information given on the instruments ... 20
5.13 Algorithm to evaluate the indicated value ... 20
5.14 Classification of the dosemeters ... 20
6 General test procedures ... 20
6.1 Instructions for use ... 20
6.2 Nature of tests ... 21
6.3 Reference conditions and standard test conditions ... 21
6.4 Tests for influence quantities of type F ... 21
6.5 Tests for influence quantities of type S ... 21
6.6 Consideration of non-linearity ... 21
6.7 Consideration of several detectors or signals in a dosemeter ... 21
6.8 Position of dose equivalent (rate) meter for test purposes ... 22
6.9 Low dose equivalent rates ... 22
6.10 Statistical fluctuations ... 22
6.11 Production of reference radiation ... 22
6.12 Reference photon radiation ... 22
6.13 Reference beta radiation ... 23
6.14 Determination of dose equivalent (rate) response ... 23
7 Additivity of indicated value ... 23
7.1 Requirements ... 23
7.2 Method of test ... 23
7.3 Interpretation of the results ... 24
8 Radiation performance requirements and tests ... 24
8.1 General ... 24
8.2 Consideration of the uncertainty of the conventional quantity value ... 24
8.3 Model function ... 24

8.4 Variation of the response due to photon radiation energy and angle of incidence ... 24
8.4.1 Measuring quantity $H'(0,07)$ or $\dot{H}'(0,07)$ ... 24
8.4.2 Measuring quantity $H^*(10)$ or $\dot{H}^*(10)$ ... 25
8.5 Variation of the response due to beta radiation energy and angle of incidence ... 26
8.5.1 Measuring quantity $H'(0,07)$ or $\dot{H}'(0,07)$ ... 26
8.5.2 Measuring quantity $H^*(10)$ or $\dot{H}^*(10)$ ... 27
8.6 Response to neutron radiation ... 28
8.6.1 Requirements ... 28
8.6.2 Test method ... 28
8.7 Linearity and statistical fluctuations ... 28
8.7.1 General ... 28
8.7.2 Requirements ... 28
8.7.3 Method of test ... 28
8.7.4 Interpretation of the results ... 29
8.8 Overload characteristics ... 30
8.8.1 Dose equivalent meters ... 30
8.8.2 Dose equivalent ratemeters ... 30
8.9 Response time ... 31
8.9.1 Dose equivalent meters ... 31
8.9.2 Dose equivalent ratemeters ... 31
8.10 Interrelation between response time and statistical fluctuations ... 32
8.11 Variation of the response due to dose rate dependence of dose measurements ... 32
8.11.1 General ... 32
8.11.2 Requirements ... 32
8.11.3 Method of test using radiation sources ... 33
8.11.4 Method of test using natural radiation ... 33
8.11.5 Interpretation of the results ... 33
8.12 Response to pulsed ionizing radiation fields ... 33
8.12.1 Requirements ... 33
8.12.2 Test method ... 33
8.13 Requirements on the accuracy of alarm of dose equivalent (rate) monitors ... 33
8.13.1 Dose equivalent alarm ... 33
8.13.2 Dose equivalent rate alarm ... 34
9 Electrical characteristics of directional and ambient dose equivalent (rate) meters ... 35
9.1 Stability of zero indication with time ... 35
9.1.1 Requirements ... 35
9.1.2 Test method ... 35
9.1.3 Interpretation of the results ... 35
9.2 Warm-up time ... 35
9.2.1 Requirements ... 35
9.2.2 Test method ... 35
9.2.3 Interpretation of the results ... 35
9.3 Power supplies ... 36
9.3.1 General ... 36
9.3.2 Requirements ... 36
9.3.3 Test method ... 36

10 Mechanical characteristics of directional and ambient dose equivalent (rate) meters 37
10.1 Shock during operation (microphonics) 37
10.1.1 General 37
10.1.2 Requirements 37
10.1.3 Method of test and interpretation of the results 37
10.2 Drop test during transport 38
10.2.1 Requirements 38
10.2.2 Test method 38
10.2.3 Interpretation of the results 38
10.3 Orientation of dose equivalent (rate) meter (geotropism) 38
10.3.1 General 38
10.3.2 Requirements 38
10.3.3 Test method 38
11 Environmental characteristics, performance requirements and tests 39
11.1 General 39
11.2 Ambient temperature 39
11.2.1 Requirements 39
11.2.2 Test method 39
11.2.3 Interpretation of the results 39
11.3 Relative humidity 39
11.3.1 Requirements 39
11.3.2 Test method 39
11.3.3 Interpretation of the results 40
11.4 Atmospheric pressure 40
11.4.1 Requirements 40
11.4.2 Test method 40
11.5 Sealing against moisture 40
11.6 Storage and transport 40
11.7 Electromagnetic compatibility 40
11.7.1 General 40
11.7.2 Emission of electromagnetic radiation 41
11.7.3 Electrostatic discharge 41
11.7.4 Radiated electromagnetic fields 41
11.7.5 Conducted disturbances induced by radio-frequencies 42
11.7.6 50 Hz/60 Hz magnetic field 42
12 Software 43
12.1 General 43
12.2 Requirements 43
12.2.1 General requirements 43
12.2.2 Design and structure of the software 43
12.2.3 Protection of the software and data 43
12.2.4 Documentation 44
12.3 Method of test 44
12.3.1 General 44
12.3.2 Testing the documentation 45
13 Summary of characteristics 45
14 Documentation 45

14.1 Information on the instrument 45
14.2 Certificate 45
14.3 Operation and maintenance manual 46
14.4 Type test report 46
Annex A (normative) Statistical fluctuations 52
Annex B (informative) Usage categories of ambient/directional dose (rate) meters 54
Annex C (informative) Calibration of ambient dose equivalent (rate) meters for environmental monitoring 55
Bibliography 57

Table 1 – Measuring quantities and energy ranges covered by the standard 8
Table 2 – Symbols (and abbreviated terms) 16
Table 3 – Values of c_1 and c_2 for w different dose (rate) values and n indications for each dose (rate) value 46
Table 4 – Reference conditions and standard test conditions 47
Table 5 – Radiation characteristics of directional dose equivalent (rate) meters 48
Table 6 – Radiation characteristics of ambient dose equivalent (rate) meters 49
Table 7 – Electrical, mechanical and environmental characteristics of directional and ambient dose equivalent (rate) meters 50
Table 8 – Maximum values of deviation due to electromagnetic disturbances 50
Table 9 – Mechanical performance under test conditions 51
Table A.1 – Number of instrument readings required to detect true differences (95 % confidence level) between two sets of instrument readings on the same instrument 53
Table B.1 – Usage categories of ambient or directional dose (rate) meters 54

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RADIATION PROTECTION INSTRUMENTATION – AMBIENT AND/OR DIRECTIONAL DOSE EQUIVALENT (RATE) METERS AND/OR MONITORS FOR BETA, X AND GAMMA RADIATION –

Part 1: Portable workplace and environmental meters and monitors

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60846-1 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

This edition cancels and replaces the second edition of IEC 60846 published in 2002 of which it constitutes a technical revision. It also replaces IEC 61017-1:1991 and IEC 61017-2:1994 as far as portable equipment is concerned.

The text of this standard is based on the following documents:

FDIS	Report on voting
45B/603/FDIS	45B/611/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 60846 series can be found, under the general title *Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation*, on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

RADIATION PROTECTION INSTRUMENTATION – AMBIENT AND/OR DIRECTIONAL DOSE EQUIVALENT (RATE) METERS AND/OR MONITORS FOR BETA, X AND GAMMA RADIATION –

Part 1: Portable workplace and environmental meters and monitors

1 Scope and object

This part of the IEC 60846 series applies to dose equivalent (rate) meters and/or monitors for the measurement of ambient dose equivalent (rate) and/or directional dose equivalent (rate) from external beta, X and gamma radiation, as recommended in ICRU, Report 47.

NOTE 1 If both quantities, ambient dose equivalent and directional dose equivalent are meant, the term dose equivalent may be used as an abbreviation.

This part of IEC 60846 series applies only to portable meters and monitors which are intended to be used in both the workplace and the environment. It applies to devices that measure the dose equivalent or dose equivalent rate from external beta and/or X and gamma radiation in the dose range between 0,01 μSv and 10 Sv and the dose rate range between 0,01 μSv h^{-1} and 10 Sv h^{-1} and in the energy ranges given in the following Table. All the energy values are mean energies with respect to the prevailing dose quantity.

Table 1 – Measuring quantities and energy ranges covered by the standard

Measuring quantity	Energy range for Photon radiation	Energy range for Beta-particle radiation
$H^*(10)$	12 keV to 10 MeV	—
$H'(0,07)$	8 keV to 250 keV	0,07 MeV[a] to 1,2 MeV almost equivalent to E_{max} from 225 keV to 3,54 MeV

[a] For beta-particle radiation, an energy of 0,07 MeV is required to penetrate the dead layer of skin of 0,07 mm (almost equivalent to 0,07 mm of ICRU tissue) nominal depth.

NOTE 2 Where a dose rate meter or monitor may be attached to a supplementary probe used to monitor contamination, the relevant standard for that probe is IEC 60325.

If national legislation requires the use of different measuring quantities, for example, air kerma or exposure, the standard may be used with the respective adjustments.

In this document, the expression "dose equivalent (rate)" is used when the provisions apply to both the measurement of dose equivalent and the measurement of dose equivalent rate.

NOTE 3 It does not apply to medical radiology which is within the scope of technical committee 62, where the conditions of radiation exposure may be extremely inhomogeneous, but precisely known.

NOTE 4 It does not apply to instruments intended to be worn by an individual for the purpose of estimating the radiation dose received by that individual.

The object of this standard is to specify the design requirements and the performance characteristics of dose equivalent (rate) meters intended for the determination of ambient dose equivalent (rate) and directional dose equivalent (rate) as defined in ICRU Report 47.

Accordingly, this standard specifies:

a) general characteristics, the functions and performance characteristics of dose equivalent (rate) meters;

b) the methods of test to be used to determine compliance with the requirements of this standard.

Some countries may wish to use this type of dose equivalent (rate) meter for measurements in the framework of legal metrology.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-151:2001, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*

IEC 60050-393:2003, *International Electrotechnical Vocabulary (IEV) – Part 393: Nuclear instrumentation – Physical phenomena and basic concepts*

IEC 60050-394:2007, *International Electrotechnical Vocabulary (IEV) – Part 394: Nuclear instrumentation – Instruments, systems, equipment and detectors*

IEC 60068-2-31:2008, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60086-1:2006, *Primary batteries – Part 1: General*

IEC 60086-2:2006, *Primary batteries – Part 2: Physical and electrical specifications*

IEC 60359:2001, *Electrical and electronic measurement equipment – Expression of performance*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
Amendment 1 (1999) [1]

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*
Amendment 1 (1998)
Amendment 2 (2000) [2]

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
Amendment 1 (2007) [3]

IEC 61000-4-6:2008, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:1993, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*
Amendment 1 (2000) [4]

---

1 There exists a consolidated edition (2.1) which includes IEC 60529 (1989) and its Amendment 1 (1999).

2 There exists a consolidated edition (1.2) which includes IEC 61000-4-2 (1995), its Amendment 1 (1998) and its Amendment 2 (2000).

3 There exists a consolidated edition (3.1) which includes IEC 61000-4-3 (2006) and its Amendment 1 (2007).

4 There exists a consolidated edition (1.1) which includes IEC 61000-4-8 (1993) and its Amendment 1 (2000).

IEC 61000-6-2:2005, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61187:1993, *Electrical and electronic measuring equipment – Documentation*

IEC/TR 62461:2006, *Radiation protection instrumentation – Determination of uncertainty in measurement*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC Guide 99:2007, *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

ISO 4037-1:1996, *X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy – Part 1: Radiation characteristics and production methods*

ISO 4037-2:1997, *X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy – Part 2: Dosimetry for radiation protection over the energy ranges 8 keV to 1,3 MeV and 4 MeV to 9 MeV*

ISO 4037-3:1999, *X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy – Part 3: Calibration of area and personal dosemeters and the measurement of their response as a function of energy and angle of incidence*

ISO 4037-4:2004, *X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy – Part 4: Calibration of area and personal dosemeters in low energy X reference radiation fields*

ISO 6980-1:2006, *Nuclear energy – Reference beta-particle radiation – Part 1: Methods of production*

ISO 6980-2:2004, *Nuclear energy – Reference beta-particle radiation – Part 2: Calibration fundamentals related to basic quantities characterizing the radiation field*

ISO 6980-3:2006, *Nuclear energy – Reference beta-particle radiation – Part 3: Calibration of area and personal dosemeters and determination of their response as a function of beta radiation energy and angle of incidence*

3 Terms and definitions

For the purposes of this document, the definitions given in IEC 60050-393, IEC 60050-394 and IEC 60359, as well as the following terms and definitions apply.

3.1
acceptance test
a contractual test to prove to the customer that the device meets certain conditions of its specification

3.2
ambient dose equivalent
$H^*(10)$
dose equivalent at a point in a radiation field that would be produced by the corresponding expanded and aligned field in the ICRU sphere at a depth of 10 mm on the radius opposing the direction of the aligned field

NOTE 1 The SI unit of ambient dose equivalent is the sievert (Sv) or its decimal multiples or submultiples (e.g. mSv).

NOTE 2 The ambient dose equivalent (rate), used for the monitoring of strongly penetrating radiation, is not an appropriate quantity for any beta radiation even that which is nominally penetrating (ICRU Report 47, 1992).

NOTE 3 When the term dose equivalent alone is used in this standard, the quantities ambient dose equivalent and directional dose equivalent are implied.

3.3
ambient dose equivalent rate
$\dot{H}^*(10)$
ratio of dH*(10) by dt, where dH*(10) is the increment of ambient dose equivalent in the time interval dt

$$\dot{H}^*(10) = \frac{\mathrm{d}H^*(10)}{\mathrm{d}t}$$

NOTE The SI unit of ambient dose equivalent rate is the sievert per second (Sv s^{-1}). Units of ambient dose equivalent rate are any quotient of the sievert or its decimal multiples or submultiples by a suitable unit of time (e.g. mSv h^{-1}).

3.4
coefficient of variation
v
ratio of the estimate of standard deviation s to the arithmetic mean $\bar{x}$ of a set of n measurements

$$v = \frac{s}{\bar{x}} = \frac{1}{\bar{x}}\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

3.5
(complete) result of a measurement
set of values attributed to a measurand, including a value, the corresponding uncertainty and the unit of the measurand

NOTE 1 The central value of the whole (set of values) can be selected as measured value M and a parameter characterizing the dispersion as uncertainty.

NOTE 2 The result of a measurement is related to the indicated value given by the instrument G and to the values of correction obtained by calibration and by the use of a model.

NOTE 3 The estimation of M can be based on one or more indicated values.

[IEV 311-01-01, modified]

3.6
conventional quantity value
H
quantity value attributed by agreement to a quantity for a given purpose

NOTE 1 The term "conventional true quantity value" is sometimes used for this concept, but its use is discouraged.

NOTE 2 Sometimes a conventional quantity value is an estimate of a true quantity value.

NOTE 3 A conventional quantity value is generally accepted as being associated with a suitably small measurement uncertainty, which might be zero.

NOTE 4 In this standard the quantity is the dose equivalent (rate).

[VIM 2.12]

3.7
deviation
D
difference between the indicated values for the same value of the measurand of a dose equivalent (rate) meter, when an influence quantity assumes, successively, two different values
[IEV 311-07-03, modified]

$$D = G - G_r$$

where G is the indicated value under the effect of an influence quantity and
G_r is the indicated value under reference conditions.

NOTE 1 The original term in IEV 311-07-03 reads “variation (due to an influence quantity)”. In order not to confuse variation (of the indicated value) and variation of the response, in this standard, the term is called “deviation”.

NOTE 2 The deviation can be positive or negative resulting in an increase or a decrease of the indicated value, respectively.

NOTE 3 The deviation is of special importance for influence quantities of Type S.

3.8
directional dose equivalent
***H*′(0,07)**
dose equivalent at a point in a radiation field that would be produced by the corresponding expanded field in the ICRU sphere at a depth of 0,07 mm, on a radius in a specified direction

NOTE The SI unit of directional dose equivalent is the sievert (Sv) or its decimal multiples or submultiples (e.g. mSv).

3.9
directional dose equivalent rate
$\dot{H}'(0{,}07)$
ratio of dH'(0,07) by dt, where dH'(0,07) is the increment of directional dose equivalent in the time interval dt

$$\dot{H}'(0{,}07) = \frac{\mathrm{d}H'(0{,}07)}{\mathrm{d}t}$$

NOTE The SI unit of directional dose equivalent rate is the sievert per second (Sv s^{-1}). Units of directional dose equivalent rate are any quotient of the sievert or its decimal multiples or submultiples by a suitable unit of time (e.g. mSv h^{-1}).

3.10
dose equivalent (rate) meter
assembly intended to measure or evaluate the dose equivalent (rate)

3.11
effective range of measurement (of a dose equivalent (rate) meter)
range of values of the quantity to be measured over which the performance of a dose equivalent (rate) meter meets the requirements of this standard

3.12
indicated value (for the purpose of this standard)
G
value given by the (digital) indication of the dosemeter in units of dose equivalent or dose equivalent rate

3.13
influence quantity
quantity that is not the measurand but that effects the result of the measurement

NOTE 1 For example, temperature of a micrometer used to measure length.

[GUM B.2.10]

NOTE 2 If the effect on the result of a measurement of an influence quantity depends on another influence quantity, these influence quantities are treated as a single one. In this standard, this is the case for the influence quantities “radiation energy and angle of radiation incidence”.

3.14
influence quantity of type F
influence quantity whose effect on the indicated value is a change in response

NOTE 1 An example is radiation energy and angle of radiation incidence.

NOTE 2 “F” stands for factor: The indication due to radiation is multiplied by a factor due to the influence quantity.

3.15
influence quantity of type S
influence quantity whose effect on the indicated value is a deviation independent of the indicated value

NOTE 1 An example is the electromagnetic disturbance.

NOTE 2 All requirements for influence quantities of type S are given with respect to the value of the deviation *D*.

NOTE 3 “S” stands for sum. The indication is the sum of the indication due to radiation and due to the influence quantity, e.g., electromagnetic disturbance.

3.16
lower limit of effective range of measurement
H_0
lowest dose (rate) value included in the effective range of measurement

3.17
maximum dose equivalent rate (for dosemeters)
$\dot{H}_{\mathrm{max}}$
doserate, specified by the manufacturer, below which the effect of the dose rate on the dose reading is within specified limits

3.18
measured value
M
value that can be obtained from the indicated value G by applying the model function for the measurement

NOTE 1 The model function is necessary to evaluate the uncertainty of the measured value according to the GUM (see GUM 3.1.6, 3.4.1 and 4.1).

NOTE 2 An example of a model function is given here. It combines the indicated value G with the reference calibration factor N_0, the correction for non-linear response r_{n}, the l deviations D_p (p = 1..l) for the influence quantities of type S, and the m relative response values r_q (q = 1..m) for the influence quantities of type F:

$$M = \frac{N_0}{r_{\mathrm{n}} \prod_{q=1}^{m} r_q} \left[G - \sum_{p=1}^{l} D_p \right].$$

NOTE 3 The calculations according to such model function are usually not performed, only in the case that specific influence quantities are well known and an appropriate correction is applied.

NOTE 4 If necessary another model function closer to the design of a certain dosemeter may be used.

NOTE 5 With the calibration controls adjusted according to the manufacture’s instructions, the reference calibre-tion factor, the correction for non-linear response and all relative response values are set to one and the deviations are set to zero, these settings cause an uncertainty of measurement which can be determined from the measured variation of the response values and the measured deviations. For a dosemeter tested according to this standard, all these data are available.